What is claimed is:

1. A separator for an electrochemical cell, comprising
   (A) a flexible perforate support,
   (B) a porous first ceramic material which fills the perforations in the support and which
      (i) has a pore structure which is characterized by an average pore size, and
      (ii) is suitable for receiving an ion-conducting electrolyte,

   characterized in that
   (C) the electrolyte-contactable pore surface of the first porous ceramic material is covered with fine particles of a further material to extend the use life, the average size of the fine particles being in the range from 0.5 to 30% and preferably in the range from 1 to 15% of the average pore size of the ceramic material.

2. The separator of claim 1, wherein the material of the fine particles is identical to or different from the porous ceramic material.

3. The separator of claim 2, wherein the material of the fine particles is different from the porous ceramic material.

4. The separator of claim 2 or 3, wherein the fine particles comprise SiO_2, Al_2O_3, ZrO_2 or SiC.

5. The separator of any of claims 2 to 4, wherein the fine particles comprise Li_2CO_3, Li_3N, $LiAlO_2$ or $Li_xAl_yTi_z(PO_4)_3$ where $1 \leq x \leq 2$, $0 \leq y \leq 1$ and $1 \leq z \leq 2$.

6. The separator of any preceding claim, comprising an electrolyte for ion conductance, preferably alkali and alkaline earth metal ion conductance and more preferably lithium ion conductance.

7. The separator of any preceding claim, wherein the fine particles are incorporated in the porous first ceramic material and are exposed on the pore surface.

8. The separator of any preceding claim, wherein the porous first ceramic material is coated with the fine particles.

9. The separator of any preceding claim, characterized in that the ceramic material has an average pore size in the range from 50 nm to 5 μm.

10. The separator of any preceding claim, wherein the porous ceramic material comprising fine particles has a porosity in the range from 10% to 70% and preferably in the range from 20% to 50%.

11. The separator of any preceding claim, wherein the ceramic material comprises an oxide of zirconium, silicon and/or preferably aluminum.

12. The separator of any preceding claim, wherein the first ceramic material is producible by solidifying a slip which contains particles having a large average particle size which determine the pore structure of the ceramic material and also particles having a smaller average primary particle size which adhere the large particles together in the course of the solidification of the slip.

13. The separator of any preceding claim, wherein the perforate support comprises polymeric fibers, glass or ceramic.

14. The separator of any preceding claim, wherein the perforate support comprises fibers, preferably selected from fibers of polyamide, polyacrylonitrile, polyester and/or polyolefin, glass fibers or ceramic fibers.

15. The separator of any preceding claim, wherein the support comprises fibers and/or filaments from 1 to 150 μm and preferably from 1 to 20 μm in diameter and/or yarn from 3 to 150 μm and preferably from 10 to 70 μm in diameter.

16. The separator of any preceding claim, wherein the support is a nonwoven having a pore size from 5 to 500 μm and preferably from 10 to 200 μm.

17. The separator of any preceding claim that is stable under service conditions at not less than 100°C, preferably at not less than 150°C and most preferably at not less than 180°C.

18. The separator of any preceding claim, from 10 to 1 000 μm, preferably from 10 to 100 μm and most preferably from 10 to 50 μm in thickness.

19. The separator of any preceding claim that tolerates a bending radius down to 100 mm, preferably down to 20 mm and most preferably down to 1 mm.

20. A process for producing a separator for an electrochemical cell as claimed in any of claims 1 to 19, comprising the following steps:

(a) applying a dispersion as a thin layer onto and into a woven and/or nonwoven, the

dispersion comprising

(a1) large ceramic particles whose average particle size provides a pore structure to the layer that is characterized by an average pore diameter,

(a2) fine particles whose average particle size is in the range from 0.5 to 30% and preferably in the range from 1 to 15%, of the average particle size of the ceramic material, and also

(a3) optionally, ceramic particles having an average primary particle size which is substantially less than the average particle size of the ceramic particles as per (a1) and (a2),

(b) solidifying the dispersion at a temperature from 100°C to 680°C to form a separator.

21. The process of claim 20, wherein the dispersion in step (a) further comprises a sol, preferably of the elements aluminum, zirconium and/or silicon.

22. A process for producing a separator for an electrochemical cell as claimed in any of claims 1 to 19, comprising the following steps:

(i) providing a composite formed from a perforated support, preferably a woven and/or nonwoven, and also a porous ceramic material whose pore structure is characterized by an average pore size,

(ii) treating the composite with a dispersion of fine particles having an average particle size in the range from 0.5 to 30% and preferably in the range from 1 to 15% of the average pore size in a dispersion medium so that the electrolyte-accessible pore surface of the composite is coated with the dispersion and the dispersion preferably

contains from 1 to 25% by weight, especially from 5 to 15% by weight of fine particles;

(iii) drying the dispersion at a temperature in the range from 100°C to 680°C so that the coated pore surface is coated with the fine particles.

23. The process of claim 22, wherein the composite is a separator which is obtainable by the process of claim 20 or 21.

24. The process of any of claims 20 to 23, wherein the dispersion contains one or more additional components selected from adhesion promoters, dispersing assistants, agents for setting the viscosity, agents for setting the flow properties or other customary assistants for producing dispersions.

25. The process of any of claims 20 to 24, wherein the dispersion medium contains water and the fine particles are hydrolysis-stable element oxide particles.

26. The process of any of claims 20 to 24, wherein the dispersion medium is an anhydrous organic solvent and the fine particles comprise hydrolysis-sensitive materials.

27. The process of any of claims 20 to 26, wherein the ceramic particles comprise a material selected from the group consisting of aluminum oxide, silicon oxide and zirconium oxide or mixtures thereof.

28. An electrochemical cell, especially a lithium battery, lithium ion battery or a lithium polymer battery, wherein the cell comprises a separator as claimed in any of claims 1 to 19.

29. The use of the separator as claimed in any of claims 1 to 19 for producing an electrochemical cell, especially a lithium battery, lithium ion battery and/or a lithium polymer battery, each preferably for high current applications.